PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference E-2191/04	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IT2004/000347	International filing date *(day/month/year)* 15.06.2004	Priority date *(day/month/year)* 27.02.2004
International Patent Classification (IPC) or both national classification and IPC INV. B60C7/22 B60C9/18		
Applicant FIAT AUTO S.p.A. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 11 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
30.06.2005	09.06.2006
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Buergo, J Telephone No. +49 89 2399-8884

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IT2004/000347

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1, 4-15	as originally filed
2, 3	filed with telefax on 30.06.2005

Claims, Numbers

1-51	filed with telefax on 30.06.2005

Drawings, Sheets

1/6-6/6	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☒ the claims, Nos.: 52

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application,

   ☒ claims Nos. 8-12

   because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

   ☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 8-12 are so unclear that no meaningful opinion could be formed *(specify)*:

   see separate sheet

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the Standard.

   ☐ the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-7,13-51
	No: Claims	
Inventive step (IS)	Yes: Claims	1-7,13-51
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-7,13-51
	No: Claims	

2. Citations and explanations

see separate sheet

V. Reasoned statement

2. Citations and explanations

2.1 INDEPENDENT CLAIM 1

Document US 2002/124929 A1 (D1) discloses (the references in parenthesis applying to this document):
a tyre for vehicles which has an axis of symmetry and comprises a tread **110**, two sidewalls **150**, and two beads **160** which are attached to a wheel rim **10** [and are] made of elastomer material, additionally comprising one tubular reinforcement body **120** for coaxial reinforcement on the said axis, which is surrounded by the said tread and extends between the said sidewalls, each of which comprising a respective resilient annular membrane with a straight generatrix which forms an angle other than 90° with the axis of the tyre.

The subject-matter of claim 1 differs from the disclosure of D1 in the features of the characterizing portion. This combination of features is neither shown nor suggested by the available prior art documents, and would meet the requirements of Article 33(3) PCT regarding inventive step.

2.2 INDEPENDENT CLAIM 50

The combination of the features of independent claim 51 is neither known from, nor rendered obvious by, the available prior art. Its subject-matter appears to be new and to involve an inventive step.

2.3 Dependent claims 8 to 12 refer to a subject-matter which is no longer part of the invention and should thus have been deleted.

2.4 The description and the claims are not consistent. It should make clear that what relates to the tubular body 18 is not part of the invention.

source of troublesome noise emissions. The type, dimensions and distribution of these transverse channels on the tread are therefore always a compromise between the various requirements.

In addition, the known tyres require periodic checks on the inflation pressure, which varies over a period of time as a result of the inevitable leakages, and the tyres also need to be replaced if they are punctured.

Finally, the known tyres determine the geometry of the rim, which must have a perimetric tubular portion which is free from apertures, in order to delimit the chamber for the pressurised fluid, and must permit fitting of the inflation valve. For these reasons, in the known solutions, the wheel/rim assembly has relatively high weights which generate inevitable forces of inertia, which, as is known, affect both the acceleration and the braking.

DISCLOSURE OF INVENTION

The object of the invention is thus to provide a tyre for vehicles which makes it possible to solve the above-described problems simply and economically, and in particular which makes it possible to obtain a high level of driving comfort in any condition in which it is used.

According to the present invention, a tyre is provided for vehicles, in particular for motor vehicles, which has an axis of symmetry and comprises a tread, two sidewalls, two beads which are attached to a wheel rim made of elastomer material, and at least one tubular reinforcement body which is coaxial to the said axis, is

surrounded by the said tread, and extends between the said sidewalls; each of the said sidewalls comprising a respective resilient annular membrane with a straight generatrix which forms an angle other than 90° with the axis of the tyre; characterised in that the said tubular reinforcement body comprises an annular belt and a plurality of blocks which are supported by the said annular belt in positions which are adjacent to one another, and can be forced against one another in order to apply resistance to the circumferential actions of compression which are present on the tyre during rotation of the tyre itself.

Preferably, in the above-defined tyre, the said tubular body has a dimension, measured parallel to the said axis, which is substantially the same as that of the tread measured in the same direction. Also preferably, the said membranes are stretched between the said tread and the said beads, such as to be pre-tensioned in the absence of loads on the tyre.

Also preferably, the generatrices of the said membranes converge towards one another such as to meet at a point outside the tread. Alternatively, the generatrices of the said membranes converge towards one another such as to meet at a point inside the tyre.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the attached figures, which illustrate some non-limiting embodiments of it, in which:

figure 1 illustrates in front elevation a preferred embodiment of a tyre produced according to the dictates of the present invention;

C L A I M S

1. Tyre (3; 30) for vehicles, in particular for motor vehicles, which has an axis (13) of symmetry and comprises a tread (16), two sidewalls (15), two beads (8) which are attached to a wheel rim (2) made of elastomer material, and at least one tubular reinforcement body (18;35) for coaxial reinforcement on the said axis (13), which is surrounded by the said tread (16) and extends between the said sidewalls (15); each of the said sidewalls comprising a respective resilient annular membrane (24) with a straight generatrix which forms an angle (A) other than 90° with the axis (13) of the tyre (3); characterised in that the said tubular reinforcement body (35) comprises an annular belt (36) and a plurality of blocks (37) which are supported by the said annular belt in positions adjacent to one another, and can be forced against one another in order to apply resistance to the circumferential actions of compression present on the tyre during the rotation of the tyre itself.

2. Tyre according to claim 1, characterised in that the said tubular body (18;35) has a dimension measured parallel to the said axis (13) which is substantially the same as that of the tread (16) measured in the same direction.

3. Tyre according to claim 1 or 2, characterised in that the said tubular body (18;35) has lateral through-apertures (21).

4. Tyre according to claim 3, characterised in that at least some of the said through-apertures (21) are apertures which are elongate in the circumferential direction.

5. Tyre according to claim 3 or 4, characterised in that at least some of the said apertures (21) are aligned with one another circumferentially in order to form a circumferential row of apertures.

6. Tyre according to claim 5, characterised in that the said tubular body (18;35) comprises at least one pair of the said circumferential rows of apertures which are spaced from one another in the axial direction.

7. Tyre according to any one of the preceding claims, characterised in that the said tubular body (18;35) is delimited by respective cylindrical surfaces which are coaxial to the axis (13); at least one of the said cylindrical surfaces has a generatrix line which is straight and parallel to the axis (13) of the tyre (3).

8. Tyre according to one of claims 1 to 6, characterised in that the said tubular body (18) is a corrugated body.

9. Tyre according to claim 8, characterised in that the said tubular body has at least one circumferential rib (19).

10. Tyre according to any one of the preceding claims,

characterised in that the said tubular body (18) is made of harmonic steel.

11. Tyre according to any one of claims 1 to 9, characterised in that the said tubular body (18;35) is made of plastics material.

12. Tyre according to any one of the preceding claims, characterised in that the tubular body (18;35) is at least partially embedded in the said tread (16).

13. Tyre according to any one of the preceding claims, characterised in that the said membranes (24) are made of anisotropic material.

14. Tyre according to claim 13, characterised in that the said membranes (24) are reinforced with fibres which are disposed and oriented such as to prevent localised deformations of the membranes in a loaded condition.

15. Tyre according to claim 14, characterised in that the said membranes (24) are reinforced such as to contain the tension forces which are present on the membranes (24) themselves in static load conditions above a dihedron (26) which is tangent to the beads (8) and has a vertex parallel to the axis (13).

16. Tyre according to any one of the preceding claims, characterised in that the generatrices of the said membranes (24) converge towards one another in order to meet at a point outside the tread (16).

17. Tyre according to any one of claims 1 to 15, characterised in that the generatrices of the said membranes (24) converge towards one another in order to meet at a point inside the tyre (3).

18. Tyre according to any one of the preceding claims, characterised in that the said membranes (24) have cross-sections which are substantially constant in a radial direction.

19. Tyre according to claim 18, characterised in that the said cross-sections are substantially rectangular cross-sections.

20. Tyre according to any one of the preceding claims, characterised in that the said beads (8) comprise at least one annular projection (9) which can engage with a corresponding retention seat (7) when it is fitted onto the wheel rim (2).

21. Tyre according to any one of the preceding claims, characterised in that the said tread (16) comprises a plurality of apertures (20) for communication with the interior of the tyre; the said apertures (20) being provided to correspond with an equivalent number of apertures (21) provided through the said tubular body (18;35).

22. Tyre according to claim 21, characterised in that the said apertures are closed by means of materials which are permeable to water, and can prevent the

intake of foreign bodies into the tyre.

23. Tyre according to claim 22, characterised in that the said materials which are permeable to water are porous materials.

24. Tyre according to any one of the preceding claims, characterised in that the said tread (16) is vulcanised onto an outer surface of the said tubular body (18;35).

25. Tyre according to any one of the preceding claims, characterised in that the said tread (16) comprises a plurality of outer circumferential grooves (22), and in that the said grooves communicate with the interior of the tyre via a plurality of through-radial passages (20,21).

26. Tyre according to any one of the preceding claims, characterised in that the said membranes (24) are stretched radially between the said tread and the said beads (8) such as to be pre-tensioned in the absence of loads on the tyre.

27. Tyre according to any one of claims 1 to 12, characterised in that the said membranes (24) are made of homogeneous elastomer material.

28. Tyre according to claim 27, characterised in that the said homogeneous material is an isotropic material.

29. Tyre according to claim 27 or 28, characterised in that the said membranes (24) are made of polybutadiene rubbers.

30. Tyre according to claim 27 or 28, characterised in that the said membranes (24) are made of polyisoprene rubbers.

31. Tyre according to claim 27 or 28, characterised in that the material of which the said membranes (24) are made comprises polycondensate of dimethylsilanol, wherein the methyl units are substituted by vinyl or phenolic units.

32. Tyre according to anyone of the preceding claims, characterised in that the said blocks (37) project from the said annular belt (36) towards the interior of the tyre.

33. Tyre according to anyone of the preceding claims, characterised in that the said annular belt (36) comprises a plurality of reinforcement threads or strips (39).

34. Tyre according to claim 33, characterised in that the said annular belt (36) comprises a portion (38) of elastomer material in which the said reinforcement threads or strips (39) are embedded.

35. Tyre according to claim 33 or 34, characterised in that the said annular belt (36) is connected integrally to the said tread (16).

36. Tyre according to claim 33 or 34, characterised in that the said tread is connected to the said annular belt (36) in a manner such that it can be released, so that it can be replaced when it reaches a wear limit.

37. Tyre according to any one of claims 34 to 36, characterised in that the said annular belt (36) is glued to the said tread (16).

38. Tyre according to any one of the preceding claims, characterised in that the said blocks (37) are tapered towards the interior of the tyre.

39. Tyre according to claim 38, characterised in that the said blocks (39) delimit between one another notches (47) which extend in a direction substantially parallel to the said axis (13).

40. Tyre according to claim 38 or 39, characterised in that the said blocks (37) are distributed in order to form a plurality of axial rows (41) parallel to the said axis (13) and a plurality of circumferential rows (42).

41. Tyre according to any one of claims 38 to 40, characterised in that the said blocks (37) are connected to one another by relative mobility means (43;53) which can permit displacement of the blocks (37) relative to one another during the rotation of the tyre (3).